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甘肃东乡晚中新世新发现的副板齿犀(奇蹄目、犀科)化石[1)]

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关键词　甘肃东乡,中新世,犀科,板齿犀
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副板齿犀(*Parelasmotherium*)是 Killgus(1923)根据采自山西的标本建立的,属型种为山西副板齿犀(*P. schansiense*)。邱占祥和谢骏义(1998)记述了产自甘肃东乡汪集的简饰副板齿犀(*P. simplum*)化石,但其准确的层位不能肯定。最近在汪集西南约 11km 的那勒寺乡有确切层位的晚中新世地层中发现一些新材料,它们显然可以归入 *Parelasmotherium* 这个属,但与上述已知的两个种都不相同。

临夏副板齿犀(新种) *Parelasmotherium linxiaense* sp. nov.

(图版 Ⅰ～Ⅱ,表 1～3)

正型标本　V 12650.1～5,属于同一个体的右 M2,左右 M3,右 m1 和左 m2。

归入标本　V 12650.6,一枚未磨蚀的右 m3。

产地及层位　甘肃省东乡县那勒寺乡郭泥沟,晚中新世早期。

鉴定特征　大型高冠板齿犀,上颊齿不分为冠部与柱部,釉质褶皱极微弱。上臼齿小刺发达,次尖大。下臼齿前、后叶同等发育,且前、后齿带发达。

名称来源　Linxia,临夏,化石产地位于临夏盆地。

对比与讨论　*Elasmotherium* 和 *Sinotherium* 的个体更大,颊齿齿冠都明显地分为冠部和柱部,釉质褶皱强烈。而 *Parelasmotherium* 个体较小,没有冠部与柱部的分化,釉质光滑或仅有发育极弱的次级小褶皱(Killgus,1923)。郭泥沟标本的个体虽然较大,但其齿冠并没有冠部和柱部的分化,也不发育釉质褶皱,所以应该归入 *Parelasmotherium* 属。

临夏副板齿犀的上颊齿宽度不仅明显大于山西副板齿犀和简饰副板齿犀,也大于拉氏中华板齿犀(*S. lagrelii*)。临夏副板齿犀的下颊齿尺寸也不小于拉氏中华板齿犀。郭泥沟标本釉质褶皱极微弱,因而釉质层较光滑,而简饰副板齿犀和山西副板齿犀可以见到微弱发育的釉质褶皱。临夏副板齿犀 M2 和 M3 的小刺都非常发达,其中 M2 的小刺末端变宽并且分岔,还有发达的后小刺;原尖舌缘的垂向沟从嚼面至基部都保持在中央位置;后齿带明显位于齿冠上部;后脊与外脊的连接处收缩成细颈,其宽度还不到后脊的一半,以至形成一个巨大的次尖。上述这些特点都与山西副板齿犀和简饰副板齿犀不同。

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在郭泥沟的副板齿犀新材料中包括 3 枚下颊齿,这是特别重要的发现,因为以前从未记述过副板齿犀的下颊齿标本。从下颊齿看, *Parelasmotherium* 与 *Sinotherium* 的差别也相当显著。*Parelasmotherium* 下颊齿的釉质褶皱极其微弱,而 *Sinotherium* 下颊齿的釉质褶皱是非常发达的; *Sinotherium* 下颊齿的咀嚼面与牙齿垂向呈斜交的关系,而在 *Parelasmotherium* 中是直交的;Ringstrom(1924)没有提到 *Sinotherium* 下颊齿有发达的齿带,而 *Parelasmotherium* 下颊齿的前、后齿带都相当发达; *Parelasmotherium* 下颊齿的前、后叶同等发育,而 *Sinotherium* 与 *Elasmotherium* 相似,前叶不如后叶发育。

从东乡发现的副板齿犀的新材料看,这个属显然与 *Sinotherium* 和 *Elasmotherium* 有更密切的关系,因为在板齿犀这一类中,个体明显巨大而牙齿又真正达到高冠(M2 冠高显著地大于齿冠长或宽)并完全被白垩质充填和覆盖的,只有 3 个属,即 *Elasmotherium*, *Sinotherium* 和 *Parelasmotherium* (邱占祥和谢骏义,1998)。而 *Parelasmotherium* 不褶皱的釉质显示它比后两个属更原始。在副板齿犀已知的 3 个种内, *P. linxiaense* 以其极微弱的釉质褶皱比 *P. schansiense* 和 *P. simplum* 略显原始。

东乡县那勒寺乡郭泥沟一带的晚新生代地层非常发育,且出露良好,地层层序由下到上为:1) 浅棕色块状泥岩;2) 灰色、黄色含砾砂岩;3) 薄层浅棕色和浅黄橘色黏土互层;4) 灰色、局部呈锈黄色砂砾岩,产铲齿象动物群化石;5) 块状泥质粉砂岩,产丰富的三趾马动物群化石。临夏副板齿犀化石即产于此层的最底部,与其共生的其他哺乳动物化石包括 *Hipparion*、*Ningxiatherium*、*Shaanxispira*、*Tetralophodon* 和 *Dinocrucuta*,此层之上为不整合面;6) 积石砾岩层;7) 黄土。该地点的剖面图参见邱占祥等(印刷中)。由于含临夏板齿犀化石的层位之下为含中中新世铲齿象动物群的地层,所以临夏板齿犀的时代应为晚中新世早期。从汪集的 *P. simplum* 比 *P. linxiaense* 略显进步的特征判断,前者的层位可能稍高于后者。

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NEW REMAINS OF PARELASMOTHERIUM (PERISSODACTYLA, RHINOCEROTIDAE) FROM THE LATE MIOCENE IN DONGXIANG, GANSU, CHINA

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Abstract *Parelasmotherium linxiaense* sp. nov., discovered from the *Hipparion* fauna in Dongxiang County, Gansu Province, China, has large size, relatively weak enamel plications, and marked crista and hypocone to be distinguished from *P. schansiense* and *P. simplum*. The first discovery of the lower cheek teeth of *Parelasmotherium* is very important, because we can recognize more characters of *Parelasmotherium* different from those of *Sinotherium* based on them. This new species has an accurate horizon, and its age is the early Late Miocene.

Key words Dongxiang, Gansu, Miocene, Rhinocerotidae, elasmothere

Parelasmotherium was established by Killgus (1923) based on specimens collected from Shanxi. Its type species is *P. schansiense*. Ringstrom (1924) considered this species synonymous with *Sinotherium lagrelii* collected from Baode, Shanxi, or a subspecies of the latter, at most. But Qiu and Xie (1998) pointed out that *Parelasmotherium* is smaller in size, its upper cheek teeth not differentiated into crown and prism parts, almost no enamel crenulation. These characters are markedly different from those of *Sinotherium*. As a result, they suggested restoring the genus *Parelasmotherium*. They also referred *Sinotherium simplum* established by Chow (1958) to the genus *Parelasmotherium*, and added some specimens from Wangji Village in Dongxiang, Gansu to *P. simplum*. Unfortunately, stratigraphic position of the Wangji specimens could not be precisely determined. Recently, some new specimens were discovered from the Late Miocene deposits in a long section at Nalesi Village situated 11km to the southwest of Wangji. They can obviously be identified as the genus *Parelasmotherium*, but are different from the two known species of this genus. In this locality, accompanying fossils include *Hipparion*, *Ningxiatherium*, *Shaanxispira*, *Tetralophodon* and *Dinocrucuta*.

1 Systematic paleontology

Family Rhinocerotidae Owen, 1845
Subfamily Rhinocerotinae Dollo, 1885
Tribe Elasmotheriini Dollo, 1885
Genus *Parelasmotherium* **Killgus, 1923**
Parelasmotherium linxiaense **sp. nov.**
(Pls. I～II; tables 1～3)

Holotype V 12650.1～5, right M2, left and right M3, right m1 and left m2, belonging apparently to one and the same individual.

Referred specimen V 12650.6, an unworn right m3.

Locality and horizon Guonigou in Nalesi Village, Dongxiang County, Gansu Province, China, early Late Miocene.

Diagnosis Large hypsodont elasmothere. Upper cheek teeth not differentiated into crown and prism parts. Enamel scarcely folded. Upper molars have well-developed crista and large hypocone. Lower molars have the same developed trigonid and talonid, as well as well-developed anterior and posterior cingula.

Etymology Linxia, this holotype is collected from the Linxia Basin.

Description The M2 has a narrow worn surface with labial length longer than lingual one and with its width increases toward its root. Its labial wall is flat, with weak paracone fold. The protocone is flat on lingual side, where a vertical groove is gradually developed downward; the anterior and posterior constriction folds of protocone are weak; the antecrochet is wide and short; and the protoloph strongly inclined backward. Metaloph connects with ectoloph by a narrow neck in connection so that the hypocone looks very large. Hypocone has round lingual margin and no constriction. Metaloph is also strongly inclined backward and has no crochet. Crista is large and bifid at end, while postcrista short and narrow. Metastyle is relatively long. Posterior cingulum is close to the worn surface. Middle valley is wide and open. Posterior valley is narrow and deep. There are no lingual and labial cingula.

M3 has a triangular worn surface. Its fine and sharp paracone is projecting forward, with a wide and shallow fold. Protocone has flat lingual margin with two indistinct grooves and weak constrictions. Protoloph strongly projects backward, with very narrow connection with ectoloph and without antecrochet. Ectoloph has an even width. There are a long crista and a smaller postcrista. Middle valley is wide and deep. Anterior and posterior cingula are well-developed.

Table 1 Measurements and comparisons of M2 of *Parelasmotherium linxiaense* **sp. nov.** (mm)

Measure	*P. linxiaense*	*P. simplum* (Qiu and Xie, 1998)	*P. schansiense* (Qiu and Xie, 1998)	*S. lagrelli* (Ringstrom, 1924)
Lmax	～100	80	83	
Lbas	～75	63		92
W at Lmax	52	58	60 ?	
Wmax	80	74.8		75
Hlab	132	118	130	106
Lmax/ Hlab	～0.76	0.67	0.64	0.59

Table 2 Measurements and comparisons of M3 of *Parelasmotherium linxiaense* **sp. nov.** (mm)

Measure	*P. linxiaense*	*P. simplum* (Qiu and Xie, 1998)	*S. lagrelii* (Ringstrom, 1923, 1924)
Lmax	90	74	106
Lbas	90	76.5	
W at Lmax	77.5		
Wmax	77.5	50	60
Hlab	109	128	90
Lmax/ Hlab	0.83	0.58	1.18

Paralophid of m1 is relatively narrow. Its protolophid is wide, with small and projecting paraconid. Metaconid constricts slightly. Anterior valley is wide and shallow, and posterior one deep. Metaconid and entoconid have flat lingual margins. The base of crown becomes short markedly. Labial groove is widely V-shaped. Anterior and posterior cingula are curved downward. Anterior cingulum is closed to worn surface, but posterior one is lower.

The shape of m2 is similar to that of m1 but with larger size, and m2 has no projecting paraconid.

The m3 is an unworn specimen. Its anterior cingulum is in the upper 1/3 of the crown, and posterior in the half of the crown. The trigonid is obviously higher than the talonid, and posterior valley deeper than anterior one.

Table 3 Measurements and comparisons of the lower molars of *Parelasmotherium linxiaense* **sp. nov.** (mm)

Measure	m1		m2		m3
	P. linxiaense	*S. lagrelli* (Ringstrom, 1924)	*P. linxiaense*	*S. lagrelli* (Ringstrom, 1924)	*P. linxiaense*
Lmax	66.5	59	79	77	78
Lbas	40		50		50
W at Lmax	30		39		36
Wmax	37	46	41	44	42.3
Hlab	73.4		79		115 (unworn)
Lmax/ Hlab	0.91		1		0.68

2 Comparison and discussion

Qiu and Xie (1998) indicated that among the elasmotheres there are only three genera

with true hypsodont teeth (height by far surpasses length or width in M2) : *Elasmotherium* , *Sinotherium* and *Parelasmotherium* .

Both *Elasmotherium* and *Sinotherium* are of large size. Their teeth are differentiated into crown and prism parts, and have particularly complex enamel plications. Whereas, *Parelasmotherium* is smaller in size without differentiation into crown and prism parts in upper cheek teeth, and almost no fine enamel crenulation (Killgus, 1923). Although the Guonigou specimens are considerably large, their crowns are not differentiated into crown and prism parts, and enamel crenulation is scarcely developed. Consequently, they should be assigned to the genus *Parelasmotherium*.

For rhinocerotids, especially the hypsodont elasmotheres, the measurements of length and height of their worn teeth have little value in comparison, because degrees of wear affect greatly these two parameters. On the other hand, width at the crown base is a useful parameter for comparisons since it is not affected by wear. The upper cheek teeth of *P. linxiaense* are not only apparently wider than those of *P. schansiense* and *P. simplum*, but also wider than those of *S. lagrelli*.

The new materials of *Parelasmotherium* from Guonigou include three lower cheek teeth. This is a very important discovery, because Killgus (1923), Chow (1958), and Qiu and Xie (1998) did not have any lower cheek tooth when they described *Parelasmotherium*. This new discovery makes us recognize characters on the lower cheek teeth of *Parelasmotherium* and compare with those of *Sinotherium*. Seeing from their lower cheek teeth, differences between *Parelasmotherium* and *Sinotherium* are relatively notable. Corresponding to its upper cheek teeth, the enamel plications on the lower cheek teeth of *Parelasmotherium* are very weak, on the contrary, ones of *Sinotherium* are well developed. In the side view, the lower cheek tooth row of *Sinotherium* is a sector, because the premolars incline backward while the molars forward. As a result, the worn surface is bevel with the vertical axis of the teeth in *Sinotherium*, but orthogonal in *Parelasmotherium*. Ringstrom (1924) did not describe that the lower cheek teeth of *Sinotherium* have well-developed cingula. On the other hand, the anterior and posterior cingula of the lower cheek teeth of *Parelasmotherium* are well-developed, and the anterior cingulum of m3 extends to the middle of its labial wall, which implies that this tooth had a long-term pause in its eruption. Both the trigonid and talonid of the lower cheek teeth in *Parelasmotherium* are developed, but the trigonid is less developed than the talonid in *Sinotherium* as *Elasmotherium*.

Consequently, three species have been known in the genus *Parelasmotherium* until now, i. e. *P. schansiense*, *P. simplum* and *P. linxiaense*. Kretzoi (1942) divided elasmotheres into two subfamilies based on horn position on skull: Elasmotheriinae with a large horn on the frontal and Iranotheriinae with a horn on the nasal end. The Elasmotheriinae include *Sinotherium* and *Elasmotherium*. Heissig (1989) considered that *Ningxiatherium longirhinus*, established by Chen (1977), was a transitional form from the Iranotheriinae to Elasmotheriinae. Fortelius and Heissig (1989) supported this opinion. But Cerdeno (1995) placed *Ningxiatherium* and *Elasmotherium* in a monophyletic group that is much closer to other Rhinocerotini than to the *Iranotherium* group. According to the new material from Dongxiang, *Parelasmotherium* obviously has closer relationship to *Sinotherium* and *Elasmotherium*, and the unfolded enamel of *Parelasmotherium* indicates that this species is more primitive than other two species. The teeth of *Ningxiatherium* are very low crowned, but with markedly folded enamel, so it is impossible to be the ancestor of *Parelasmotherium*. Cerdeno (1995) also admitted that the tooth characters of *Ningxiatherium* are similar to those of *Iranotherium* but different from those of *Elasmotherium*. In the three known species, the scarcely folded enamel of *P. linxiaense* implies that it is slightly more primitive than *P. schansiense* and *P. simplum*.

Nearby Guonigou in Nalesi Village ,Dongxiang County ,the Late Cenozoic strata are well developed and exposed. The stratigraphic sequence from lower to upper follows: 1) light brown blocky mudstones; 2) grey and yellow gravelly sandstone; 3) alternating thin-bedded light brown and light orange clays; 4) gray and locally rusty yellow sandstones and fine gravels, in which the fossils of the *Platebelodon* fauna exists; 5) blocky and muddy siltstones, in which the fossils of the *Hipparion* fauna are very abundant. The specimens of *Parelasmotherium* come from the bottom of Layer 5, and the accompanying mammalian fossils include *Hipparion*, *Ningxiatherium*, *Shaanxispira*, *Tetralophodon* and *Dinocrucuta*. An unconformity exists on the top of Layer 5; 6) the Jishi conglomerate layer; and 7) loess. The stratigraphical section of this locality can be seen in Qiu et al. (in press). Because the layer bearing the Middle Miocene *Platebelodon* fauna is underlying the layer bearing *P. linxiaense*, the age of this rhino should be the early Late Miocene. Judging from slightly more advanced characters of *P. simplum* from Wangji than *P. linxiaense*, the horizon of the former may be a little higher than that of the latter.

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References

Cerdeno E, 1995. Cladistic analysis of the Family Rhinocerotidae (Perissodactyla). Am Mus Novit, (3143): 1～25

Chen G F(陈冠芳), 1977. A new genus of Iranotheriinae of Ningxia. Vert PalAsiat (古脊椎动物学报), **15**(2): 143～147 (in Chinese)

Chow M C(周明镇), 1958. New elasmotherine rhinoceroses from Shansi. Vert PalAsiat (古脊椎动物学报), **2**(2/3): 131～142

Fortelius M, Heissig K, 1989. The phylogenetic relationships of the Elasmotherini (Rhinocerotidae, Mamm.). Mitt Bayer Staatssls Palaont Hist Geol, **29**: 227～233

Heissig K, 1989. The Rhinocerotidae. In: Prothero D R, Schoch R M eds. The Evolution of Perissodactyla. New York: Oxford Univ Press. 399～417

Killgus H, 1923. Unterpliozane Sauger aus China. Mitt Geol Palaeont Inst Univ Tubingen Palaeont Zeits, **5**(3): 251～257

Kretzoi M, 1942. Bemerkungen zum System der nachiiozanen Nashorn-Gattungen. Foldt Kozl, **72**: 309～318

Qiu Z X (邱占祥), Wang B Y (王伴月), Deng T (邓涛) et al., (in press). A preliminary report on the mammal fauna from lower loess deposits at Longdan, Dongxiang County, Gansu Province. Quat Sci (第四纪研究) (in Chinese with English abstract)

Qiu Z X (邱占祥), Xie J Y (谢骏义), 1998. Notes on *Parelasmotherium* and *Hipparion* fossils from Wangji, Dongxiang, Gansu. Vert PalAsiat (古脊椎动物学报), **36**(1): 13～23 (in Chinese with English summary)

Ringstrom T, 1923. *Sinotherium lagrelii*, a new fossil rhinocerotid from Shansi. Bull Geol Surv China, **5**(1): 91～93

Ringstrom T, 1924. Nashorner der *Hipparion* Fauna Nord-Chinas. Pal Sin, Ser C, **1**(4): 1～156

图版说明(Explanations of plates)
图版 I (Plate I)

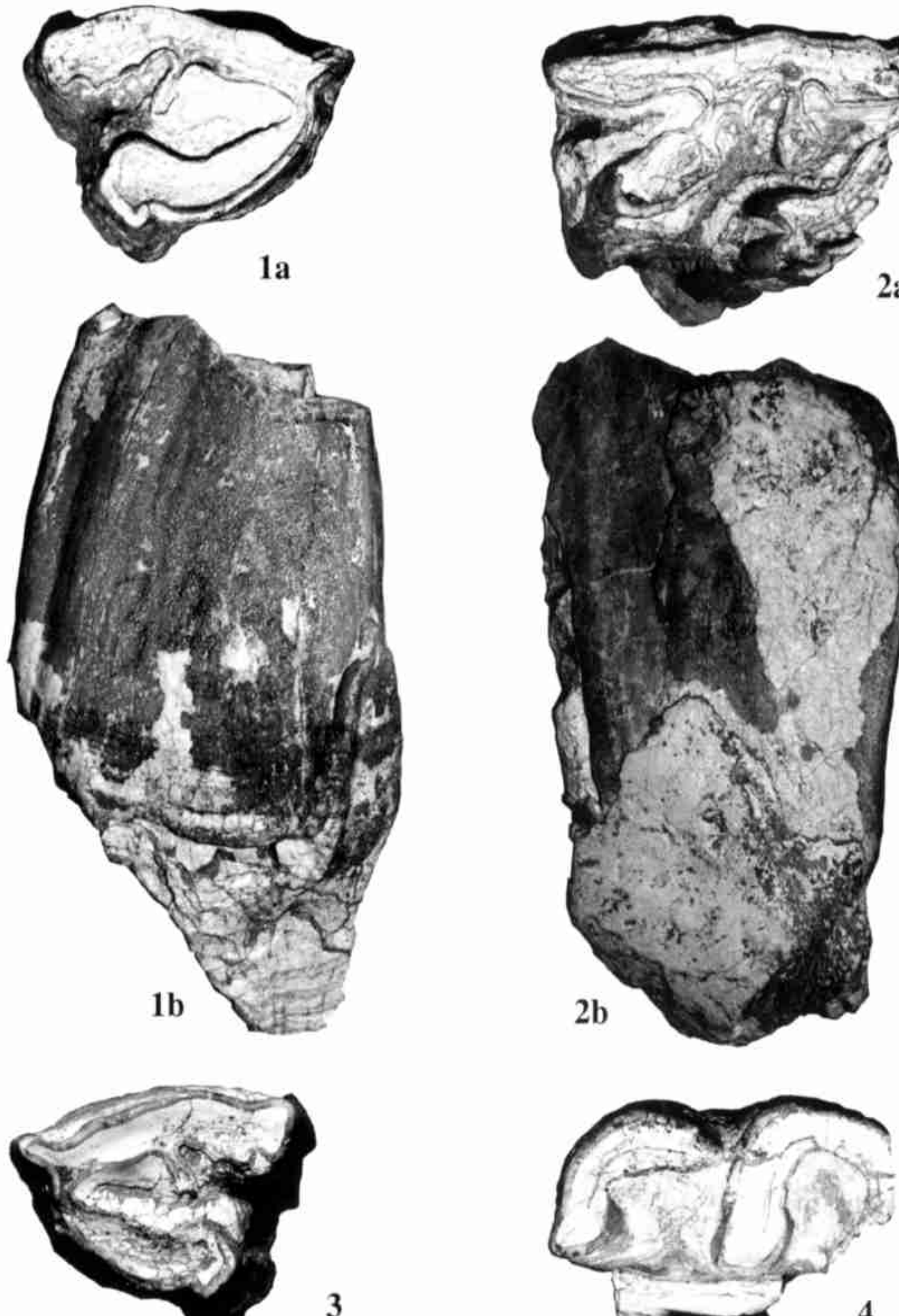
1～4. *Parelasmotherium linxiaense* sp. nov., 颊齿(cheek teeth), 正型 (holotype), ×2/3

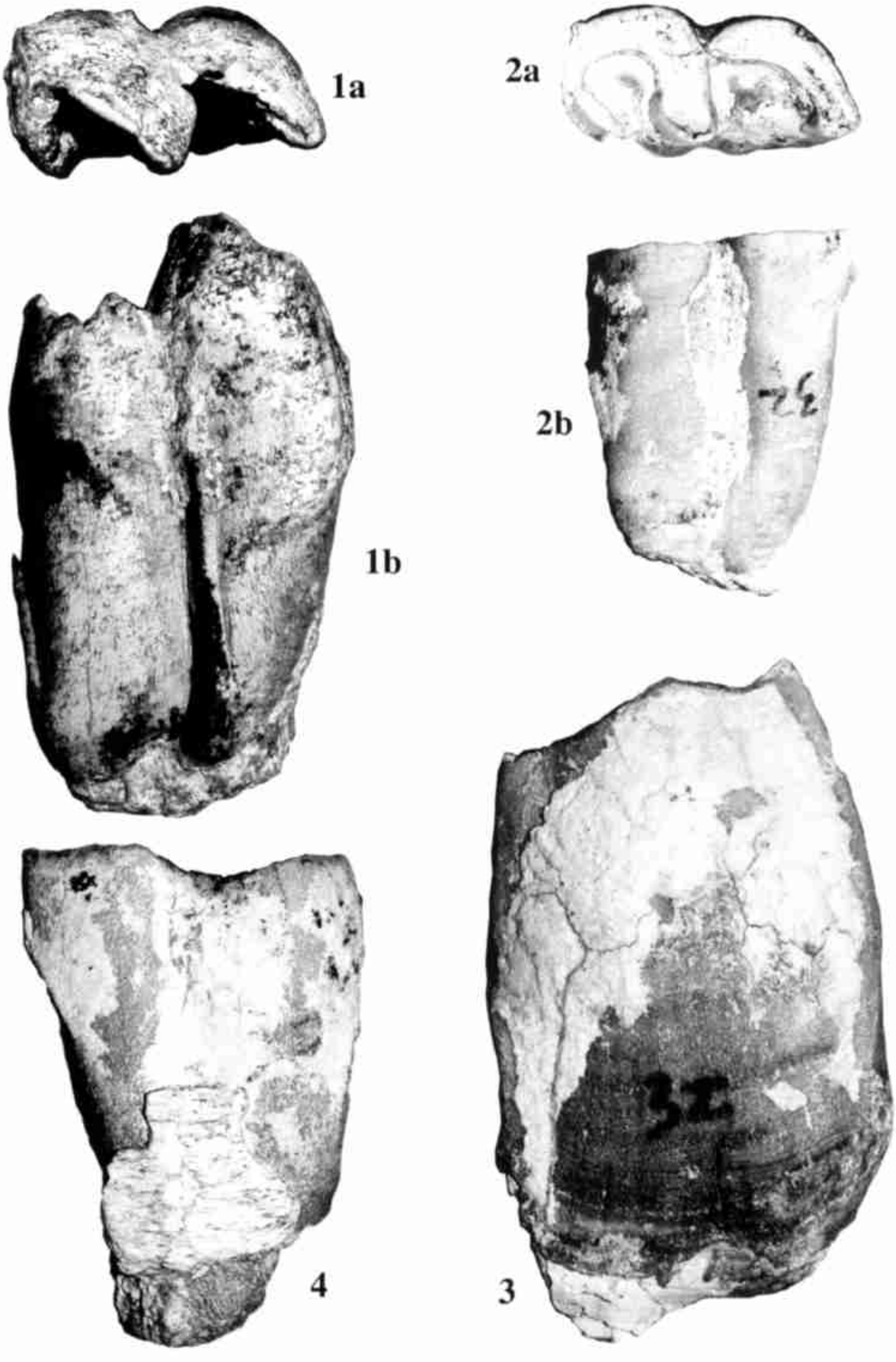
1. V12650.3, 右 M3 (right M3), la. 冠面(occlusal view), 1b. 外壁(exterior view); 2. V12650.1, 右 M2 (right M2), 2a. 冠面 (occlusal view), 2b. 外壁 (exterior view); 3. V 12650.2, 左 M3 (left M3), 冠面 (occlusal view); 4. V12650.5, 左 m2 (left m2), 冠面(occlusal view).

图版 II (Plate II)

1～4. *Parelasmotherium linxiaense* sp. nov., 颊齿(cheek teeth), ×2/3

1. V 12650.6, 右 m3 (right m3), 1a. 冠面(occlusal view), 1b. 外壁(exterior view); 2. V 12650.4, 右 m1 (right m1), 正型(holotype), 2a. 冠面(occlusal view), 2b, 外壁(exterior view); 3. V 12650.2, 左 M3 (left M3), 正型(holotype), 外壁(exterior view); 4. V 12650.5, 左 m2 (left m2), 正型(holotype), 外壁 (exterior view)


1a
2a
1b
2b
3
4


1a
2a
1b
2b
4
3